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CLAIMS

1. An order charge separation apparatus comprising a source of order charge, an order charge selector/separator, order charge output system(s) and/or order charge collector(s), and the same being arranged in series, and/or cascades so as to purify the order charge and/or effectuate order-charge type separation.

2. An order charge separation apparatus as claimed in 1, wherein the active element of the order charge selector/separator acts in other ways other than by the ordering force/charge, such as a high resolution mass spectrometer in which the active element is electromagnetic which acts upon the matter carrying the order charge rather than on the order charge itself, and in which the order charge is fed into the apparatus in such a way that the order-charged states can be separated from order neutral states, and in which there is/are output system(s) and/or order charge collectors, so that the order charge can be used directly and/or collected for subsequent use.

3. An order charge separation apparatus as claimed in 1, where the active element of the order charge selector/separator is based upon the ordering force and/or order charge, for example previously separated order charge so as to create an order charge spectrometer, and into which order charge is fed, either from previous separation in a device such as that in claim 2 and/or some other source, and the said order charge is acted upon directly by the ordering force in the active element to initiate the separation of order charge types, for example into like and unlike types, and sequences of such stages, as in claims 1, 2 and 3 here, and/or repeated processing so as to purify the order charge types and/or eventually separate and/or purify all the order charge types.

4. An order charge separation apparatus as claimed in 1, 2 and/or 3, wherein there is/are or is/are not suitable input interface(s), with or without ionization equipment, with or without suitable output interface(s), together with suitable vacuum systems, optics, and/or slits and/or baffles, and/or supporting equipment, and the system(s) is/are tuned and operated so as to separate order charged matter from order-neutral matter and/or to separate and/or to purify one order-charge type from another until one, two or all order charge types have been separated from each other and/or purified.

5. An order charge separation apparatus as claimed in 1, 2, 3 and/or 4, or combination thereof, wherein the source is a source of ionizing radiation, such as an alpha emitter, which carries the order charge on at least some of the particles of radiation.

6. An order charge separation apparatus as claimed in 1, 2, 3 and/or 4, or combination thereof, wherein the source is some form of matter, some or all of which carries the order charge such as helium from a reactor, and/or order-charged states which have previously been through some stage or stages of separation, and/or purification, and/or concentration, which may or may not be ionized electrically.

7. An order charge separation apparatus as claimed in 1, 2, 3 and/or 4, or combination thereof, wherein the source is some kind of radiation device, such as a nuclear reactor

or accelerator, in which the device produces order-charged matter either continuously or in bursts, or some combination, either partially or totally ionized or non-ionized, which then may or may not have to be separated or concentrated, or otherwise processed either continuously or in batches, so as to produce a supply of order-charged matter which can then be fed to or supplied to the source of the order-charge separation apparatus as its source of order-charged matter.

8. An order charge separation apparatus as claimed in 1, 2, 3 and/or 4, or combination thereof, wherein the source is some kind of radioactive halo and/or rock and/or crystal and/or material there from, and/or other material substance which contains order charge, which may/or may not have to be first processed to carry out some kind of preliminary order-charge concentration either on the basis of the region of origin of the matter, and/or the particular properties of the matter which is known to carry the order charge, and/or on some other basis.

9. An order charge separation apparatus as claimed in 1, 2, 3 and/or 4, or combination thereof, wherein the source is some kind of particle accelerator, nuclear or heavy ion accelerator and/or storage ring and/or colliding beam machine, which by processes of suitable interactions (which may be brought about by a beam of nuclei being made to collide with target nuclei [heavier nuclei may produce more order-charged fragments, but any nuclei which produce some order-charged fragments will do], or by a beam or source of elementary particles or other matter or radiation being made to collide with target nuclei or vice versa, so that some order-charged fragments or radiation are produced), causes nuclei to fragment into fragments, some or all of which are order-charged.

10. An order charge separation apparatus as claimed in 1, 2, 3, 4 and 9, or combination thereof, wherein there may be include further apparatus, for example, the fragments produced may or may not be mass and/or momentum and/or direction selected, and /or cooled, and/or decelerated, and/or accelerated, and/or focused into a beam of fragments, and/or ionized.

11. An order charge separation apparatus as claimed in 1, 2, 3 and/or 4, or combination thereof, wherein the source of order charge consists of free order charge which has subsequently been attached to matter (for example, matter which has been exposed to sunlight, even if it was originally order-neutral, can become filled with orderons [which are order-charged or at least order-antiorder charged], and so become permeated with some form of order charge, which said order charge may not be actually directly attached to the nuclei, although these charges could be attached indirectly, for example by order van der Waals forces), so that the said matter which has free order charge attached to it (for example by being exposed to orderons), which may or may not be processed to put it in a state suitable for separation and/or collection, is used as a source of order charge.

12. An order charge separation apparatus as claimed in 1, 2, 3, 4 and 5, or combination thereof, wherein the radiation is passed through an input interface if necessary, and then separated, collected and/or concentrated in someway to concentrate or enhance the flux, and/or wherein the radiation has been ionized, and/or turned into a beam, and/or focused, and/or concentrated, and/or deflected, and/or decelerated or

degra[illegible]. and/or accelerated, and/or some combination of these.

13. An order charge separation apparatus as claimed in 1, 2, 3, 4 and 6, or combination thereof, wherein the order-charged matter is passed through an input interface if necessary, and suitably ionized, and/or turned into a beam, and/or focused, and/or concentrated, and/or deflected, and/or decelerated, and/or accelerated, and/or some combination of these.

14. An order charge separation apparatus as claimed in 1, 2, 3, 4 and 7, or combination thereof, wherein the order-charged matter is passed through an input interface if necessary, and suitably ionized, and/or turned into a beam, and/or focused, and/or concentrated, and/or deflected, and/or decelerated, and/or accelerated, and/or some combination of these.

15. An order charge separation apparatus as claimed in 1, 2, 3, 4 and 8, or combination thereof, wherein the order-charged matter is passed through an input interface if necessary, and suitably ionized, and/or turned into a beam, and/or focused, and/or concentrated, and/or deflected, and/or decelerated, and/or accelerated, and/or some combination of these.

16. An order charge separation apparatus as claimed in 1, 2, 3, 4, 9 and/or 10, or combination thereof, wherein the fragments are passed through an input interface if necessary, and suitably ionized, and/or turned into a beam, and/or focused, and/or concentrated, and/or deflected, and/or decelerated, and/or accelerated, and/or some combination of these.

17. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and/or 16, or combination thereof, wherein there is one or more sources of order charge which may be used in various ways including one at a time, sequentially, alternatively, and/or simultaneously.

18. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 and/or 17, or combination thereof, wherein there is switch-yard to facilitate switching from one source to another, if required.

19. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 and/or 18, or combination thereof, wherein the partially or completely order-charged matter is suitably prepared for separation and/or collection.

20. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and/or 19, or combination thereof, wherein the partially or completely order-charged matter is introduced into the separator, and/or collector.

21. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and/or 20, or combination thereof, wherein the partially or completely order-charged matter is passed through a separator so as to separate, partially or completely, order-charge from order-neutral states; and/or otherwise concentrate order-charge and/or order-charged states.

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22. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and/or 21, or combination thereof, wherein the separator is a mass spectrometer or mass-spectrometer type of apparatus, and/or accelerator-type of mass-spectrometer, and/or accelerator, and/or cyclotron or similar device, and/or storage ring, and/or Penning trap and/or Smith-type spectrometer, or some combination of same, in which combinations of electric and/or magnetic fields and/or time-of-flight, and/or slits, and/or other methods, separate different mass states corresponding to different order-charge states.

23. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and/or 21, or combination thereof, wherein the separator is based upon range, so that a precisely determined amount of matter is used to separate and/or concentrate order-charge and/or order-charged states at the expense of order-neutral states.

24. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and/or 23, or combination thereof, wherein the separator is a combination of range and a mass spectrometer (eg as specified in 20 and 19 respectively), so that partial separation is brought about by range, and then further separation is brought about by using a mass spectrometer, or vice versa.

25. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and/or 24, or combination thereof, wherein range attenuation is used as part of the input interface to reduce the energy of the input particles either to those that match the mass spectrometer, or to even lower energies, so as to cool and/or thermalize them, as part of an input interface which subsequently accelerates and/or focuses the order-charged states so as to match their input energy and phase space of the mass spectrometer and maximize the flux through it if so desired.

26. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and/or 21, or combination thereof, wherein the separator is some other type of spectrometer with an electric and/or magnetic field together with some kind of velocity detector/selector and/or time-of-flight device and/or energy loss device, which can separate different mass states.

27. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and/or 21, or combination thereof, wherein the separator is based on one or more other types of process which may be mass-sensitive, or may be sensitive to nuclear magnetic moments, or may otherwise be sensitive to order charge directly or indirectly, such as various types of spectrometer, diffraction, resonance processes, kinematic processes, range, diffusion, and even certain chemical reactions, which can be used to separate order-charged matter from order-neutral matter.

28. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and/or 21, or combination thereof, wherein the separator is an order-charge separator where the active element is order-charge itself, either previously separated or otherwise obtained, and/or an order-charge field, so

that order-charge states passing through this order-charge spectrometer (which may be referred to as a secondary separator, although once built it may be used as a primary separator) tend to be deflected by the order-charge and/or order field (some order-charge [like charge] will be repulsed by the separator, other charge [different charges] will be attracted by it, and when there are more than two charge states, the former will tend to be purer than the latter because the former will tend to be a single charge state, depending on how pure the separator charge and/or field is, and the latter will include all the different charges which are deflected towards the active element), whilst order-neutral states are not so deflected and so continue in their normal trajectory.

29. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27 and/or 28, or combination thereof, wherein some kind of restriction(s), limitation(s), cut(s), slit(s) and/or aperture(s), and/or optics, or other type of separation(s), either physically, logically, and/or both, or some combinations of these, is/are introduced to separate and/or concentrate order-charge states from order-neutral states, which could be made at one or more or various places in the system as required.

30. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 and/or 29, or combination thereof, wherein some kind of fixed, and/or moveable, and/or variable slit(s) and/or aperture(s) and/or barrier(s) is/are used to separate order-charged states from order-neutral states.

31. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and/or 30, or combination thereof, wherein some kind of fixed, and/or moveable, and/or variable slit(s) and/or aperture(s) and/or barrier(s) is/are used with a mass spectrometer, order-charge and/or other type of spectrometer, which may or may not be equipped with some kind of entrance aperture, and which may or may not be equipped with some kind of exit aperture and/or other apertures, and which said exit slit(s) or aperture(s) may or may not be positioned at the exit focus and may or may not be an image of the entrance slit(s) or aperture(s), to separate order-charged states from order-neutral states, for example by positioning them in a suitable way to achieve this.

32. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 and/or 31, or combination thereof, wherein the slit(s), and/or aperture(s), and/or barrier(s), and/or frequency(ies), and/or magnetic field, and/or optics, and/or timing, and/or kinematic limits, and/or any other parameters, qualities, aspects cuts, and/or conditions of the system, is/are adjusted in such a way so that the system may or may not be optimized for maximum resolution, and it may or may not be optimized for maximum flux or yield through the apparatus, and/or it may or may not be optimized in some other way, or some combination of these.

33. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24 and/or 25, or combination thereof, wherein the thickness of material traversed is sufficient to partially and/or completely separate order-charge from order-neutral states.

34. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25 and/or 33, or combination thereof, wherein range separation is supplemented by some other method of order-charge separation, in particular range separation is used as part of the input interface to the subsequent method of order-charge separation.

35. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33 and/or 34, or combination thereof, wherein some kind of active and/or triggered device, which might be a mobile shutter, or a pulsed field, electric or magnetic and/or both, or a kicker magnet, or some other mechanical and/or electronic and/or order-charged device, and/or time-of-flight system, and/or pulse height technique, and/or energy loss system, is engaged to separate one or a small group of order-charged particles and/or states from order-neutral states.

36. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34 and/or 35, or combination thereof, wherein order charge is concentrated by selecting upon those states which carry the order charge.

37. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 and/or 36, or combination thereof, wherein order-charged matter, which has different energy and/or directional properties (from those of order neutral matter) at the source, is selected upon (by selecting the said different energy and/or directional properties) to enhance the concentration of order-charged matter.

38. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36 and/or 37, or combination thereof, wherein order-charged fragments from a radioactive source or produced in nuclear collisions which have some kind of direction and/or velocity, and/or momentum, and/or particle-type differences, are selected upon to enhance the order charge flux and/or composition, and/or purity,

39. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37 and/or 38, or combination thereof, wherein selection at source achieves sufficient purity that it is not necessary to combine it with a suitable order-charge separator.

40. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38 and/or 39, or combination thereof, wherein there is some kind of output interface if necessary, and/or output system (eg to act as a source), and/or some kind of collector to collect the order charge.

41. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39 and/or 40, or combination thereof, wherein the output interface, if necessary, and/or output system, and/or the collector is/are some kind of stopping device and/or container, suitably shaped, if necessary, to collect the order charge and/or if necessary minimize the discharge of order charge.

42. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 and/or 41, or combination thereof, wherein the collector, which can be a container, suitably shaped if necessary, or hopper, attached to the source and/or separator, or separate from it if necessary, depending upon the type of material to be collected, is designed to trap and if necessary stop the order-charged matter, and/or order charge, and/or other matter, as it leaves the source and/or separator.

43. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41 and/or 42, or combination thereof, wherein the output of the source and/or separator is in a vacuum or semi-vacuum and is moving, and this output passes through any valves and/or diaphragms and/or apertures as necessary, into the stopper and/or collector, so that the output is slowed and/or stopped, and then either contained, and/or extracted from the vacuum.

44. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 and/or 43, or combination thereof, wherein the stopper is a Faraday cup, and/or metal plate, and/or other material, solid, liquid or gaseous (provided that it does not spoil the vacuum too much, for example it might be in a containing material or materials), which stops and may or may not absorb the order-charged materials.

45. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43 and/or 44, or combination thereof, wherein the stopper absorbs the order-charged materials, and there is a way or ways of extracting the order-charged materials and/or order charge either on-line or off-line, either continuously or in steps.

46. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44 and/or 45, or combination thereof, wherein the stopper is a metal plate or other material which is removed after absorbing the order-charged material for a certain time, and either the order charge is used and/or extracted off-line, or this is a stage in the manufacture of the stopping material (eg as a component for another machine or even another machine which requires order charge).

47. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45 and/or 46, or combination thereof, wherein the stopper consists of or contains fluid in the stopper, and this fluid is extracted and/or circulated either continuously or after a certain amount of time, taking most of the order charge with it for subsequent separation.

48. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46 and/or 47, or combination thereof, wherein the stopper is made to re-emit the order charged matter, either continuously or in stages, for example by heating, so that it can then be collected in

a surrounding container, and/or extracted from the vacuum by a pump, for example a high velocity of rotation rotary vacuum pump, and then pumped into a suitable container to minimize loss and/or leakage of order charge.

49. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47 and/or 48, or combination thereof, wherein the stopper is moveable, either discretely and/or as a continuous strip, and it is first moved to a separate area in the vacuum chamber which could be partially or even completely protected from the rest of the vacuum system, where the stopper or a portion of the stopper is made to re-emit the order charged matter, either continuously or in stages, for example by heating, so that it is collected in a surrounding container, and/or extracted from the vacuum by a pump, for example a high velocity of rotation rotary vacuum pump, and then pumped into a suitable container to minimize loss and/or leakage of order charge.

50. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48 and/or 49, or combination thereof, wherein the stopper is a decelerating device, which may or may not be suitably shaped electric and/or electromagnetic fields, which slows or otherwise stops the output from the separator, so that it could then be collected in a surrounding container, and/or extracted from the vacuum by a pump, for example a high velocity of rotation rotary vacuum pump, and then pumped into a suitable container to minimize loss and/or leakage of order charge.

51. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 and/or 50, or combination thereof, wherein the container with the separated and/or purified order charge is separated (which may be done in such away that the source and/or separator can be operated continuously or in a batch mode) from the rest of the apparatus and is then taken away for use elsewhere.

52. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50 and/or 51, or combination thereof, wherein the order charge is deposited, stopped in, or otherwise applied to materials, components, and/or devices, which are subsequently going to be used in that or some other order-charged state, either to the whole of the item, or to one region, or it is applied over an extended region or several regions and/or spots, either by moving the beam of order-charged and/or by moving the material, component, and/or device, for example as part of their manufacturing process.

53. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51 and/or 52, or combination thereof, wherein the order charge is deposited, stopped in, or otherwise applied to materials, components, and/or devices, either in batch mode, or a few at a time, or partially or completely continuously, with the materials, components, and/or devices being introduced into the order beam either singly or in

groups, either a few at a time or as part of an assembly-line system with more continuous flow, for example with suitable materials handling devices.

54. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52 and/or 53, or combination thereof, wherein alternatively to, or in addition to the collector system, there is an output system, for example which provides an order-charge source, and/or order-charge beam, which is either internal or external or both, and which can be used either as a beam of order charge and/or to supply order-charge directly to where it is needed or to be used, and/or the said output system is part of an order-charge treatment plant.

55. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53 and/or 54, or combination thereof, wherein there is an output system in the form of an external beam, and there is a thin window to allow the order-charged matter to exit the system as a beam.

56. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54 and/or 55, or combination thereof, wherein there is an output system and/or collector, with optics and/or acceleration and/or deceleration as necessary to place the order charge where it is required.

57. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55 and/or 56, or combination thereof, wherein there is a detector(s), or detector system, which is/are in or can be placed or inserted in the output (separated) beam, and/or to which that beam can be directed, and/or by some other mechanism, so that matter passing through the system impinges upon the detector/detector system in order to facilitate and make possible the following operations and modes of operation, for example, so that the mass spectrum of this matter can be measured with sufficient resolution (eg to distinguish order-charged from order-neutral states), and/or so that the region(s) where the ordered-charged states occur can be determined, and/or so that the system can be adjusted/tuned, and/or so that the system can be operated to select that particular state that carries the required order charge, and/or so that the system can be run to separate order-charge states from order-neutral states (such separation systems and sequences of such systems, are referred to as "type-0 spectrometers" for convenience), and/or so that the apparatus can be arranged and/or adjusted so as to select the required order-charge state as cleanly as possible and/or to maximise the through-put and hence the efficiency, and/or so that the detector/detector system can be used to monitor performance, for example by switching it in and out of the beam as required.

58. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53,

54. 55. 56 and/or 57, or combination thereof, wherein one or more of these processes can be applied sequentially and/or in combinations.

59. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52,53, 54, 55, 56, 57 and/or 58, or combination thereof, wherein order charge, having been separated, it is subsequently used to generate suitable order fields which then subsequently separate further the order-charged states from the order-neutral states, and/or from each other (ie to separate the N order charges, where N apparently equals three).

60. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58 and/or 59, or combination thereof, wherein order charge and/or order fields is/are the active element(s) in a new type of spectrometer, an "order charge spectrometer" or simply "an order spectrometer", which acts directly upon the order charge itself.

61. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59 and/or 60, or combination thereof, wherein previously separated order charge is suitably shaped and used either as the deflecting mechanism in an order charge spectrometer, or it is combined with suitably shaped electric and magnetic fields to improve the optics and/or separating efficiency and/or flux and/or yields.

62. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60 and/or 61, or combination thereof, wherein an order spectrometer has suitable source(s), suitable input interface(s) if required, suitable output interface(s) if required, suitable output system(s) and/or suitable collector(s), and/or suitable optics, slits baffles, selecting systems, vacua and supporting equipment.

63. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61 and/or 62, or combination thereof, wherein the separation process is brought about by previously separated order charge, or by an order field, which is then used to separate order-charge from order-neutral states, and/or to further separate and/or purify order charge, for example by repeated passes, and/or repeatedly upgrading the deflecting order charge in the spectrometer, and/or by means of a series of spectrometers and/or devices.

64. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62 and/or 63, or combination thereof, wherein order charge passes by previously separated and/or purified order charged, which may or

may not be suitably shaped, and/or by an order field, and the repelled or repulsed fraction (ie the fraction which is deflected away from the active element) is collected.

65. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63 and/or 64, or combination thereof, wherein the size or quantity of the previously separated order charge in the active element, is chosen so as to arrive at a suitable compromise between the two situations, the first of which is where the quantity of order charge in the active element is small so that statistical fluctuations in the small sample are large, and there is a tendency for one of the (three) types of order charge to predominate, but the actual deflecting force exerted by that dominant charge-type is too small because the overall sample size is too small, and the second situation where the quantity of order charge in the active element is large so that the amounts of the different types of order charge are (statistically) very similar so that there is not really a dominant order-charge type and so there is little or no net order force exerted on the order charge to be separated because the active element is too close to being order neutral, rather the quantity of order-charge in the active element is chosen so as to separate, even if only statistically, on a particular order-charge type, and/or achieve a non-zero, even maximal, separation efficiency for one of the order-charge types in the repelled fraction, and the repelled fraction, especially the more strongly repelled charge, is separated and collected.

66. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64 and/or 65, or combination thereof, wherein the repulsed order charge is used to effect further separation, either by being collected and formed into a pole for the primary order-charge spectrometer that has just selected it (as in 41) and then used to replace that pole (and so form its active element), and/or is used to form the active element(s) of another and/or separate order-charge spectrometer(s), or in some other way.

67. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65 and/or 66, or combination thereof, wherein the repulsed order charge is used repeatedly to form a new pole (ie active element) of a primary order-charge separator, and/or used to form poles of secondary, tertiary and/or cascades of subsequent order-charge separators (we refer to such separation systems, and sequences of such systems, as "type-1 spectrometers" for convenience), so that the repulsed order charge is passed through the system, and the repulsed order charge is selected at each stage, and then either used to form the active element of the next (and/or repeated) stage and/or then passed through that subsequent stage and the repulsed order-charge again selected, so that ultimately a purer sample of a particular type (say type-1) of order charge is obtained.

68. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32,

33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66 and/or 67, or combination thereof, wherein the purified order charge (say type 1) is used to form the active element of an order-charge spectrometer, which for convenience we refer to as a "pure type-1 spectrometer", and of the order-charge types passed through the system, the type 1 charge is repulsed, and the types 2 and 3 are attracted and collected.

69. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67 and/or 68, or combination thereof, wherein the system is an order charge spectrometer as in claims 60, and/or 61 and/or 62, except that the previously separated order charge in these claims is here the type 2 and 3 order charge collected in a pure type-1 spectrometer, as in claim 65, so that type two or three order can start to be separated by a process of amplifying a statistical fluctuation as the type-1 charge was separated (as in claims 60 to 64, but using an active element containing type 2 and/or type 3 order charge(s)), and the repulsed and/or attracted charges is/are selected and collected, so that further separation of type 2 charge from type 3 can be effected.

70. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68 and/or 69, or combination thereof, wherein the separated charge and/or charges is/are used as the active elements of order charge spectrometers, which are arranged in repeated sequences, or series or cascades of such order charge spectrometers, similar to the way type 1 charge was separated (we refer to such separation systems, and sequences of such systems, as "type-2/3 spectrometers" for convenience), so that purer type-2 and/or type-3 order charge(s) can be separated, and one or both of these is/are selected and/or collected separately, and/or used as an output beam.

71. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69 and/or 70, or combination thereof, wherein the purified order charge, for example the collected charge from the system in claims 65 and/or 66 (say type 2), is used to form the active element of an order-charge spectrometer, which we refer to as a "pure type-2 spectrometer" (if type 2 charge is used), and which acts upon type 2 and type 3 order charges, so as to separate type-2 charge (the repelled fraction) from type-3 charge (the attracted fraction), and one or both of these are selected and collected separately.

72. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70 and/or 71, or combination thereof, wherein the purified order charge (type 3) is used to form the active element of an order-charge spectrometer, which we refer to as a "type-3 spectrometer", and which is then used to separate type-3 charge (the repelled fraction) from any other backgrounds, if it is found that the type-3 charge from the pure type-2

spectrometer is not pure enough, and once a pure enough sample of type-3 charge has been produced, it is then used in the device in this claim or in a separate but similar device as the active element to construct a "pure type-3 spectrometer".

73. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71 and/or 72, or combination thereof, wherein the various different types of spectrometer are combined together to separate the (three) order-charge types, for example the simplest arrangement of these (for three charge types) is two pure spectrometers for two different charge types (eg type-1 and type-2, or type-1 and type-3, or type-2 and type-3) in either order, which are arranged to separate order-charge from order-neutral matter, and to separate the order charge into each of its charge types, for example, a pure type-1 spectrometer will repulse order-charge of type-1, allow order-neutral states to pass straight through, and attract order charges of types -2 and -3 into the second spectrometer, which if it is of the type-2 will repulse type-2 order charge and attract type-3 order charge (a spectrometer of the third type could be added if further separation of the latter attracted fraction is required), and the various order-charge types are then selected upon and collected as required.

74. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 67, 68, 69, 70, 71, 72 and/or 73, or combination thereof, wherein the various different types of spectrometer are combined and/or cascaded, and they are fitted with suitable source(s), vacua, interfaces if required, and/or output systems if required, and/or collectors if required, and/or some combination thereof as required, and a suitable system of optics, and/or slits, and/or baffles, and/or barriers, is/are used in combination or separately to effect the various separations, and the different charges are collected as required.

75. An order charge separation apparatus as claimed in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73 and/or 74, or combination thereof, wherein the various sources, devices, components, systems, spectrometers, collectors and/or outputs are combined together in such ways as produce the order charge states, whether combined or separate, with the purities and/or in the quantities required.